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(54) Casing centralizer

(57) There is disclosed a casing centralizer/stabilizer 10 which comprises a tubular body 11 adapted to fit about a joint of casing CJ, and blades 12 extending longitudinally along the outer diameter of the body and structured to support the casing off the well bore. The blades 12 have tapered sides 12A and ends 12B. The centralizer is fixed to the casing joint CJ by set screws 13 extending through the blades 12. One blade may be provided with a permanent magnet located in hole 14A to act as a depth marker which can be detected by a logging tool.

Fig. 2

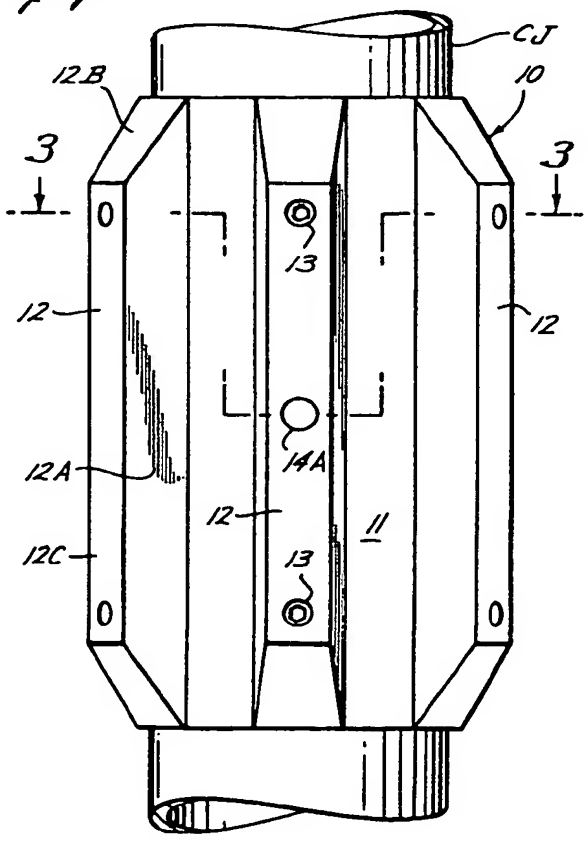

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Fig. 1

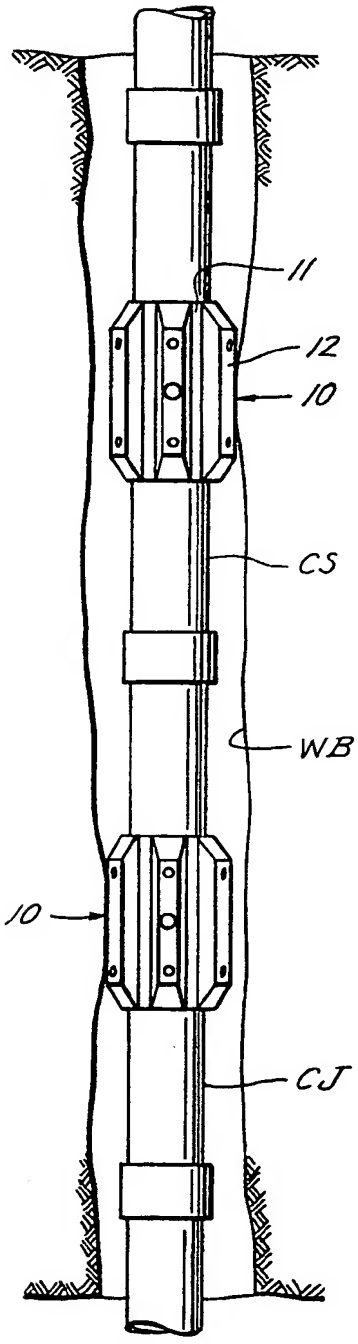


Fig. 2

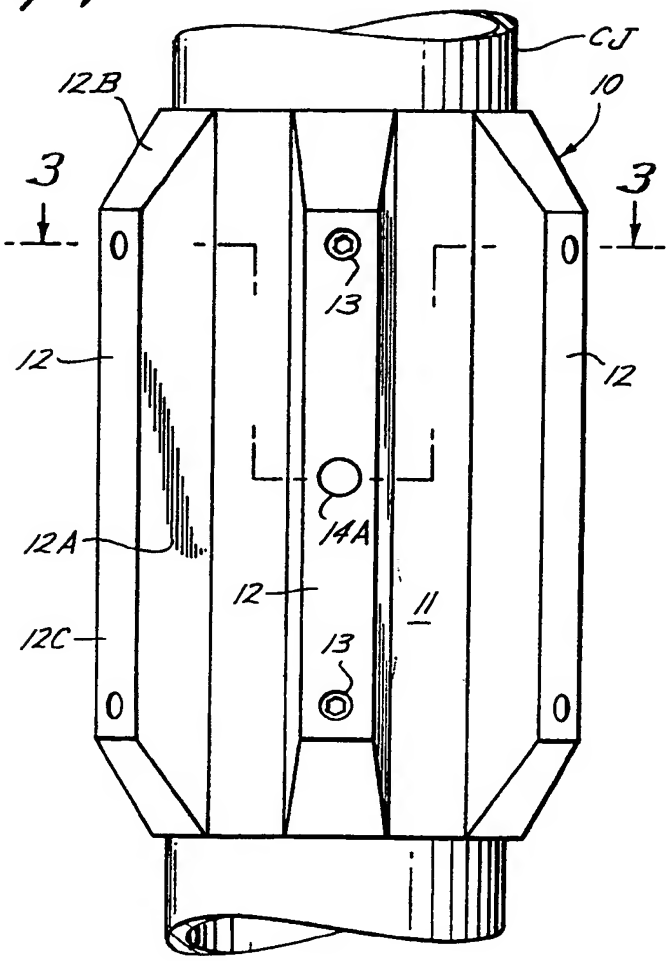
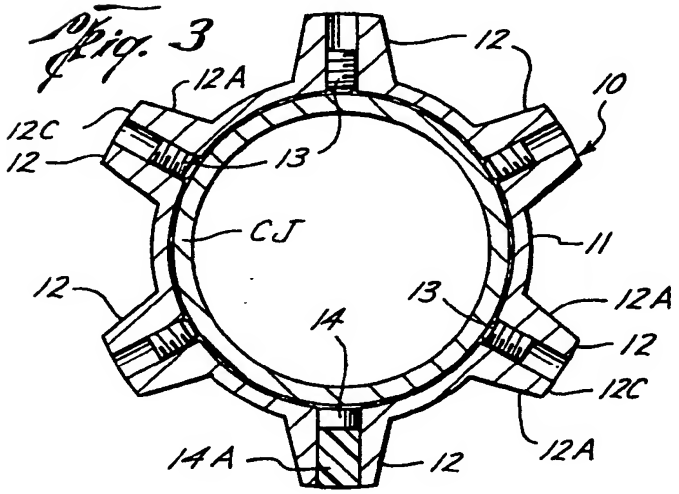


Fig. 3



SPECIFICATION

Casing centralizer/stabilizer

This invention relates generally to the completion of oil and gas wells wherein one or more strings of casing are "cemented" within the well bore. More particularly, it relates to improved tool for use in centralizing and stabilizing joints of casing in order to maintain them centered within the well bore.

In the completion of such wells, a cement slurry is pumped downwardly within each casing string and upwardly within the annulus thereabout, and thus between the well bore and the outermost string or between an inner string and the next outer string. Desirably, the cement column is of substantially uniform thickness about the casing, and, in any event, the casing should not lay up against the side of the well bore or outer casing. It is important that the casing be cemented in the center of the well bore in order to make better producing wells, prevent interzonal and intrazonal communication, and provide uniform loading which may prevent collapsed casing in the wells and zones that have a history of collapsing casing before the end life of the well. Properly centered casing is important not only in and across the production zones, but also in other zones to reduce bad cement jobs around protective casing shoe joints, and thus reduce expensive cement squeeze jobs for production and for getting good casing shoe seats.

It is therefore common practice in the industry to dispose so called centralizers along the desired length of the casing. The centralizers are so placed on the casing that after the casing is run in the well bore, the centralizers will be in a position to support the casing off the side of the well bore in zones of interest.

However, casing centralizers commonly used are not supportive enough to center the casing in the well bore resulting in bad cement coverage, and therefore non-isolated production zones. The most common centralizer used is constructed with outwardly bowed springs connected at their opposite ends to collars or sleeves which slip over or may be wrapped about the casing joint. Although the resiliency of the bow springs enables them to move through restrictions in a well bore, they may not support the weight of the casing, especially in deviated well bores. Hence, the springs on the low side of the bore may collapse to permit the casing to lay up against the well bore and thus block the passage of the cement from getting completely around the casing.

In another common centralizer of this latter type, the bow springs are replaced by solid strips of metal which are tapered at each end to provide circumferentially spaced bearing surfaces for engaging the well bore or outer casing. Although less prone to collapse than bow springs under the weight of the casing, these strips are often not strong enough to prevent bending and distortion upon encountering an obstruction in the well bore, and, in any case, are not desirably constructed for centering and/or stabilizing the casing.

The industry has come to realize that as wells are now being drilled faster and deeper, the well bore is not a true vertical hole in the earth, but has areas of directional turns, bends, and vertical deviation changes. When casing is run into the well bore it has to contour with the well bore. The outline of the casing in the well bore may result in several or continuous contacts with the well bore, with more severe contour changes resulting in more severe contacts. This realization makes a supportive casing centralizer a necessary tool towards centering the casing in a well bore to attain the desirable cement coverage around the casing.

It is therefore an object of this invention to provide a centralizer/stabilizer which, like those above described, may be disposed about a casing joint, but which is of sufficiently rigid construction as to prevent collapse or bending, support the casing in deviated and crooked well bores, and yet not unduly restrict the flow of drilling fluids and cement slurrys therepast.

More particularly, a further object of this invention is to provide a centralizer/stabilizer which is of relatively simple and compact construction.

Another object is to provide such a centralizer/stabilizer which may be firmly secured in a fixed position with respect to the casing joint.

It is often desirable to be able to determine the depth of a casing joint relative to the depth of the well bore and thus that of the formation to be produced. For this purpose, it has been proposed to mount collars having magnetic elements on the casing to provide magnetic fields which may be detected by means of conventional wireline operated logging tools lowered into the casing string. A typical device of this type, known as a "Depth Orientation Marker" is marketed by Gemoco of Houma, Louisiana.

It is a still further object of this invention to provide a centralizer/stabilizer which, in addition to accomplishing the foregoing objects, permits magnetic detection of the depth of the casing joint without the need for a separate marker.

These and other objects are accomplished, in accordance with the illustrated embodiment of this invention, by a centralizer/stabilizer which comprises a tubular body adapted to fit closely about a joint of casing, and a plurality of blades extending longitudinally along the outer diameter of the body in generally equally spaced apart relation. More particularly, each

blade has opposite sides and ends which are tapered outwardly toward one another, and a relatively wide outer surface for bearing against the well bore or an outer casing in which the casing is disposed. Thus, the centralizer/stabilizer is sufficiently strong to prevent collapse or bending out of shape, and instead will maintain the outer bearing surfaces in position to engage the well bore or an outer casing and enable the string to be raised or lowered through obstructions in the well bore. At the same time, the design of the blades provides sufficient cross sectional area between them for the passage of drilling fluids and the cement slurry.

Although it is contrmplated that the centralizer/stabilizer may be free to move vertically along and/or rotate with respect to the casing, set screws extend threadedly through holes in at least certain of the blades and body for gripping the casing in the event it is desired to fix the centralizer/stabilizer with respect to the casing. Preferably, and as illustrated, the said screws extend threadedly through holes which open onto the bearing surface, and thus provide a maximum thread length for connection to the screws.

Still further, a permanent magnet is mounted in the body near its inner diameter, and thus in a position to have its magnetic field sensed by a wire line logging tool. As shown, holes are drilled through one of the blades and the magnet is mounted in place adjacent the inner end of the hole near the bore of the body.

For purposes of ease of manufacture, and to add further to the rigidity of the overall centralizer/stabilizer, the body and blades are mold casted as one piece.

In the drawings, wherein like reference characters are used throughout to designate like parts:

Figure 1 is a vertical elevational view of a casing string within a well bore and showing centralizer/stabilizers constructed in accordance with the present invention disposed about adjacent joints of the casing string;

Figure 2 is an enlarged elevational view of one of the centralizer/stabilizers of Fig. 1; and

Figure 3 is a cross sectional view of the centralizer/stabilizer, as seen along broken lines 3–3 of Fig. 2.

As shown in Fig. 1, the well bore WB is substantially vertical, although it will be understood that it may deviate a rather substantial amount with respect to the vertical. As can also be seen from Fig. 1, the diameter of the well bore is uneven throughout its length, with restricted areas at random points along its length. The casing string CS is made up of a plurality of casing joints CJ, each having a box at one end and a pin at the other end for connection to adjacent joints making up the string.

Each of the centralizer/stabilizers constructed in accordance with the present invention, and indicated in its entirety by reference character 10, is disposed about a casing joint for maintaining the joint substantially centered within the well bore so that a cement column of substantially even thickness may form about the casing. It will be understood that the number and spacing of the centralizer/stabilizers along the length of the casing string may vary at the will of the operator of the well.

In any event, each such centralizer/stabilizer 10 comprises a tubular body 11 which is constructed to fit closely about the casing joint, as best shown in Fig. 3, and a plurality of blades 12 which extend longitudinally along the outer diameter of the body thereto in generally equal spaced apart relation. More particularly, in the illustrated and preferred embodiment of the invention, the body is of circumferentially continuous construction and of sufficient thickness for adequate strength. The side edges of adjacent blades are disposed apart to allow ample fluid passage, and yet provide bearing surfaces of ample width at the wall of the well bore. In order to assemble the centralizer/stabilizer on the casing joint CJ, the body of the centralizer/stabilizer is slipped over the pin end of the joint prior to make up of the pin with a box end on an adjacent casing joint. In the illustrated embodiment of the invention, the body and sleeve are made of a one piece mold casting of a metallic alloy such as Tenzalloy aluminium to give maximum support to the body to prevent breakage.

As also previously described, the opposite sides 12A of the blades as well as the opposite ends 12B thereof are tapered outwardly toward one another and intersect the edges of a relatively large bearing surface 12C adapted to engage the well bore or outer casing to maintain the casing substantially centered therein. As will be appreciated, the tapered ends 12B of the blades facilitate movement of the centralizer/stabilizer vertically though obstructions in the well bore. The tapered sides 12A of the blades, on the other hand, provide a wide open area between adjacent blades for the flow of cement slurry therepart.

In the illustrated and preferred embodiment of the invention, the centralizer/stabilizer is secured to the casing joint CJ at a desired position along the length thereof by means of set screws 13. As best shown in Fig. 3, each set screw extends threadedly through holes in both the blade and the body so as to bear tightly against the outer diameter of the casing joint CJ. Since the screws extend through the thickest portion of the blade, they have the largest possible threaded connection thereto. As shown, two set screws extend through each end of the blade. If, on the other hand, the centralizer/stabilizer is not secured to the casing joint so that it is free to rotate with respect thereto, its axial movement may be limited by stop collars at one or both ends.

As also best shown in Fig. 3, additional holes are drilled through one blade and the sleeve, and a permanent magnet 14 is mounted within the inner end of the hole in the body near the inner bore diameter. The outer ends of the holes are preferably filled with a body 14A of plastic. As above described, this provides a magnetic field which may be detected by a conventional wire line logging tool within the casing joint CJ.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the apparatus.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings isto be interpreted as illustrative and not in a limiting sense.

CLAIMS

1. A casing centralizer/stabilizer, comprising a tubular body adapted to fit closely about a joint of casing, and a plurality of blades extending longitudinally along the outer diameter of the body in generally equally spaced apart relation, each blade having opposite sides and ends which are tapered outwardly toward one another and a relatively wide outer surface for bearing against the well bore or an outer casing in which the casing is disposed.

2. A casing centralizer/stabilizer of the character defined in Claim 1, wherein the body and blade are mold casted as one metal piece.

3. A casing centralizer/stabilizer of the character defined in Claim 1, including set screws extending threadedly through holes in at least certain of the blades and the body for gripping the casing so as to hold the centralizer/stabilizer in place.

4. A casing centralizer/stabilizer on the character defined in Claim 1, including a permanent magnet mounted on the body near its inner diameter.

5. A casing/centralizer of the character defined in Claim 1, including means mounted on the body for detecting the depth of the body by a tool lowered into the body.

6. A casing centralizer/stabilizer on the character defined in Claim 4, wherein the magnet is mounted within a hole extending through a blade and the body.

7. A casing centralizer/stabilizer on the character defined in Claim 5, wherein the detecting means is mounted within a hole extending through a blade and the body.

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